CLAIMS

What is claimed is:

1. A resonant optical filter, comprising:
   a. a first transmission optical waveguide;
   b. a second transmission optical waveguide; and
   c. an optical resonator , evanescently optically coupled to each of the first and second transmission waveguides for transferring a resonant optical signal between the first and second transmission waveguides.

2. The resonant optical filter of Claim 1, wherein:
   a. the first transmission optical waveguide transmits therethrough a plurality of optical signals, each carried by a respective waveguide optical mode corresponding to an optical channel of a WDM system;
   b. the second transmission optical waveguide being arranged to transmit therethrough a plurality of optical signals, each carried by a respective waveguide optical mode corresponding to an optical channel of a WDM system;
   c. each of the first and second transmission waveguides including an evanescent optical coupling segment therein; and,
   d. the optical resonator being positioned so that a portion of the resonant optical mode of the resonator at least partially spatially overlaps the evanescent portion of the optical mode in the first and second transmission waveguide optical coupling segments.

3. The optical filter of Claim 2, wherein the optical resonator includes a plurality of optical resonator segments, at least two of the optical resonator segments being evanescently optically coupled therebetween.

4. The resonant optical filter of Claim 3, wherein:
   a. an optical signal entering the resonant optical filter through the first transmission optical waveguide and carried by a WDM channel substantially resonant with an optical resonance of at least one of the optical resonators is substantially transferred from the first transmission of optical waveguide to the second transmission optical waveguide and leaves the resonant optical filter through the second transmission optical waveguide; and,

b. an optical signal entering the resonant optical filter through the first transmission optical waveguide and carried by a WDM channel substantially non-resonant with any optical resonance of the coupled-optical-resonator system substantially remains within the first transmission optical waveguide and leaves the resonant optical filter through the first transmission optical waveguide.

5. The resonant optical filter of Claim 3, wherein:

a. an optical signal entering the resonant optical filter through the second transmission optical waveguide and carried by a WDM channel substantially resonant with an optical resonance of the coupled-optical-resonator system is substantially transferred from the second transmission optical waveguide to the first transmission optical waveguide and leaves the resonant optical filter through the first transmission optical waveguide; and,

b. an optical signal entering the resonant optical filter through the second transmission optical waveguide and carried by a WDM channel substantially non-resonant with any optical resonance of the coupled-optical-resonator system substantially remains within the second transmission optical waveguide and leaves the resonant optical filter through the second transmission optical waveguide.

6. The resonant optical filter of Claim 3 wherein the filter functions as an optical WDM slicer/interleaver.

7. A resonant optical filter for an optical WDM system, comprising:

a. a first transmission fiber-optic waveguide, the waveguide having a fiber-optic-taper segment therein;

b. a second transmission fiber-optic waveguide, the second waveguide having a fiber-optic-taper segment therein;

c. a resonator fiber having at least one fiber-ring resonator segments formed thereon, each fiber-ring resonator being evanescently optically coupled together and thereby acting as a single fiber-ring resonator;

d. the resonator fiber further including a taper positioner for engaging the fiber-optic-taper segment of at least one of the first and second transmission fiber optic waveguides and so as to reproducibly establish and stably maintain an evanescent optical coupling of the fiber-ring resonator and at least one of the transmission fiber optic waveguides; and

e. wherein at least one of the fiber optic taper segments of the first and second transmission fiber optic waveguides is partially wrapped around a portion of an outer circumference of at least one fiber-ring resonator segment.

8. The resonant optical filter of Claim 7 wherein the resonator fiber includes a delocalized-optical-mode suppressor.

9. The resonant optical filter of Claim 8, wherein the resonant frequencies of the fiber-ring resonator segment have been modified by beam processing.

10. The resonant optical filter of Claim 7 wherein at least one of the fiber-optic-taper segments of the first and second transmission fiber optic waveguides is longitudinally displaced from the longitudinal midpoint of at least one of the fiber-ring resonator segments, thereby substantially reducing undesirable taper-induced optical loss of at least one fiber-ring resonator segments.

11. A method for dividing a plurality of optical signals transmitted by an optical WDM system comprising the steps of receiving a plurality of optical signals, each carried by the corresponding WDM channel, into a first transmission optical waveguide;

a. routing a first set of optical signals including at least one of the received optical signals into a second transmission optical waveguide, the first set of optical signals being substantially resonant with a fiber-ring resonator evanescently optically coupled to the first and second transmission optical waveguides; and,

b. permitting a second set of optical signals to pass undisturbed along the first transmission optical waveguide, the second set of optical signals including at least one of the received optical signals and the second set of optical signals being substantially non-resonant with any optical resonance of the fiber-ring resonator.

12. A method for combining a plurality of optical signals transmitted by an optical WDM system, comprising the steps of:

a. receiving a first set of optical signals through a first transmission optical waveguide, the first waveguide being evanescently coupled to an optical resonator, the first set of optical signals being substantially non-resonant with any optical resonances of the optical resonator;

b. receiving a second set of optical signals through a second transmission optical waveguide, the second optical waveguide being evanescently optically coupled to an optical resonator, the second set of optical signals being substantially resonant with an optical resonance of the optical resonator; and,

c. routing through the optical resonator, at least one optical signal from the second set of optical signals to the first transmission optical waveguide, thereby adding an additional optical signal to the first set of optical signals transmitted in the first transmission waveguide.

13. A method for dropping an optical signal transmitted by an optical WDM system comprising the steps of:

a. receiving a plurality of optical signals, each carried by the corresponding WDM channel, into the first transmission optical waveguide, the first waveguide being evanescently optically coupled to a circumferential-mode optical resonator and at least one of such signals is substantially resonant with an optical resonance of the circumferential-mode optical resonator; and at least one of such signals is substantially non-resonant with an optical resonance of the circumferential-mode optical resonator; and,

b. routing to a second transmission optical waveguide the optical signals carried by a WDM channel substantially resonant with an optical resonance of the circumferential-mode optical resonator; the second waveguide also being evanescently optically coupled to a circumferential-mode optical resonator.

14. A method for adding an optical signal transmitted by an optical WDM system comprising the steps of:

a. receiving a first plurality of optical signals, each carried by the corresponding WDM channel, from a first transmission optical waveguide, the first waveguide being evanescently optically coupled to a circumferential-mode optical resonator, such signals being substantially non-resonant with an optical resonance of the circumferential-mode optical resonator; and,

b. receiving a second plurality of optical signals, each carried by the corresponding WDM channel, from a second transmission optical waveguide, the second waveguide also being evanescently optically coupled to the circumferential-mode optical resonator, at

least one of such second plurality of signals is substantially resonant with an optical resonance of the circumferential-mode optical resonator; and at least one of such second plurality of signals is substantially non-resonant with an optical resonance of the circumferential-mode optical resonator; and,

c. routing to the first transmission optical waveguide the optical signals from the second plurality of signals those signals which are substantially resonant with an optical resonance of the circumferential-mode optical resonator.